

AMENDMENTS TO THE CLAIMS

- 1 1. (Currently amended) A shaft for the transmission of torsional loads, the shaft  
2 comprising:  
3 an elongated inner tube member having opposing open ends;  
4 at least one end piece located adjacent at least one end of the inner tube  
5 member; said end piece including a knurled exterior surface,  
6 a composite material in contact with and covering the entire inner tube  
7 member and in contact with and covering at least a portion of the end piece; said  
8 composite material mechanically connected to said knurled exterior surface, and  
9 wherein the portion of the end piece covered by the composite material  
10 defines a convexly curved area of the end piece.
- 1 2. (Original) The shaft of claim 1 wherein the composite material includes elongated fibers,  
2 and the fibers are oriented at an angle which satisfies the condition that the angle of twist of  
3 the inner tube at failure equals the angle of twist of the composite material at failure.
- 1 3. (Previously presented) The shaft of claim 1 wherein the composite material includes  
2 elongated fibers, and substantially all of the fibers are oriented at a single angle which  
3 satisfies the conditions that the shaft have a first natural frequency greater than a  
4 predetermined maximum rotational operating speed, the shaft have a maximum operating

5 torque strength which exceeds a predetermined operating torque, and the angle of twist of  
6 the inner tube at failure equals the angle of twist of the composite material at failure.

1 4. (Previously amended) The shaft of claim 1 wherein an end piece is provided at each  
2 end of the shaft, each end piece including a knurled exterior surface.

1 5. (Original) The shaft of claim 4 wherein torsional loads are transmitted from the end  
2 pieces to the composite material through multiple load paths.

1 6. (Previously presented) The shaft of claim 5 wherein the multiple load paths comprise a  
2 direct connection between the end pieces and the composite material, and a connection  
3 from the end pieces to the inner tube and a connection from the inner tube to the  
4 composite material.

1 7. (Original) The shaft of claim 1 wherein the composite material includes elongated  
2 fibers which are oriented relative to the curvature of the portion of the end piece covered  
3 by the composite material such that, in the area of the portion of the end piece covered by  
4 the composite material, shear loads in the composite material are transferred  
5 longitudinally along the length of the fibers.

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1 9. (Original) The shaft of claim 1 wherein the inner tube comprises a mandrel used in  
2 forming the composite material on the shaft.

1 10. (Original) The shaft of claim 9 wherein an end piece is provided at each end of the  
2 shaft and the inner tube provides alignment between the end pieces during formation of  
3 the shaft.

1 11. (Original) The shaft of claim 1 further including a sacrificial layer covering the  
2 composite material.

1 12. (Previously presented) The shaft of claim 11 wherein the sacrificial layer comprises a  
2 layer thinner than the composite material, and includes fibers oriented at approximately  
3 90 degrees relative to the elongated inner tube member.

1 13. (Currently amended) A shaft for the transmission of torsional loads, the shaft  
2 comprising:  
3 an elongated inner tube member;  
4 an end piece located adjacent each end of the inner tube member;  
5 a composite material covering the inner tube member and at least a portion  
6 of each of the end piece; said composite material mechanically attached to said end piece,  
7 and

8                    wherein the composite material includes elongated fibers, said elongated  
9   fibers being wound about said inner tube member and at least a portion of each said end  
10 piece whereby ~~and the portions of the end pieces covered with the composite material~~  
11 ~~defines a geodesic isotenoid elliptical shape derived with reference to the angle of the~~  
12 ~~fibers such that, in the area of the portions of the end pieces covered by the composite~~  
13 ~~material;~~ shear loads in the composite material are transferred longitudinally along the  
14 length of the said elongated fibers.

1   14. (Previously presented) The shaft of claim 13 wherein substantially all of the fibers are  
2   oriented at a single angle which satisfies the conditions that the shaft have a first natural  
3   frequency greater than a predetermined maximum rotational operating speed, the shaft  
4   have a maximum operating torque strength which exceeds a predetermined operating  
5   torque, and the angle of twist of the inner tube at failure equals the angle of twist of the  
6   composite material at failure.

1   15. (Original) The shaft of claim 13 wherein torsional loads are transmitted from the end  
2   pieces to the composite material through multiple load paths.

1   16. (Previously presented) The shaft of claim 15 wherein the multiple load paths  
2   comprise a direct connection between the end pieces and the composite material, and a

3 connection from the end pieces to the inner tube and a connection from the inner tube to  
4 the composite material.

1 17. (Currently amended) A shaft for the transmission of torsional loads, the shaft  
2 comprising:

3 an elongated inner tube member having opposing open ends;

4 at least one end piece located adjacent at least one end of the inner tube  
5 member;

6 a composite material covering the inner tube member and at least a portion  
7 of the end piece, said composite material including elongated fibers wound about the  
8 inner tube member and end piece ~~in a geodesic isotensoid manner~~ whereby shear loads in  
9 the composite material are transferred longitudinally along the length of said elongated  
10 fibers; and

11 wherein the portion of the end piece covered by the composite material  
12 defines a convexly curved area of the end piece, said shaft being open ended at both ends.

1 18. (Currently amended) The shaft of claim 17 wherein ~~the composite material includes said~~  
2 elongated fibers, ~~and the fibers~~ are oriented at an angle which satisfies the condition that the  
3 angle of twist of the inner tube at failure equals the angle of twist of the composite material  
4 at failure.

1 19. (Currently amended) The shaft of claim 1 wherein ~~the composite material includes~~  
2 ~~elongated fibers, and~~ substantially all of the said elongated fibers are oriented at a single  
3 angle which satisfies the conditions that the shaft have a first natural frequency greater  
4 than a predetermined maximum rotational operating speed, the shaft have a maximum  
5 operating torque strength which exceeds a predetermined operating torque, and the angle  
6 of twist of the inner tube at failure equals the angle of twist of the composite material at  
7 failure.

1 20. (Previously presented) The shaft of claim 17 wherein said end piece includes a  
2 knurled exterior surface, said composite material mechanically connected to said knurled  
3 exterior surface.